Amendments to the Claims

Please cancel Claim 22. Please amend Claims 1, 14, 15, 21, 23, 26, 27 and 28. Please add new Claims 29 and 30. The Claim Listing below will replace all prior versions of the claims in the application:

Claim Listing

1. (Currently amended) A method for forming an alloy substantially free of dendrites, comprising the steps of:

   a. cooling a superheated alloy to a temperature between a solidus temperature and a liquidus temperature of the alloy to thereby form a nucleated alloy, wherein the nucleated alloy includes a plurality of nuclei~~, wherein essentially all of said nuclei are substantially free of entrapped liquid~~;

   b. ~~controlling~~ mixing the nucleated alloy at the temperature of the nucleated alloy between the solidus temperature and a liquidus temperature of the alloy, and without raising the temperature of the alloy to thereby prevent the nuclei from melting, for a period of time of at least 10 minutes;

   ~~c. mixing the nucleated alloy to distribute the nuclei throughout;~~ and

   [[d.]] c. cooling the nucleated alloy with nuclei distributed throughout to below the solidus temperature at a rate of less than about 0.7° C per second when above the solidus temperature, thereby forming an alloy having an average particle size of about 100 µm or less and substantially free of dendrites.

2. (Original) The method of Claim 1, wherein the superheated alloy is cooled at a rate of at least 15°C per second to form the nucleated alloy.

3. (Original) The method of Claim 2, wherein the alloy is superheated alloy is cooled at a rate in the range of about 20°C per second to about 30°C per second to form the nucleated alloy.

4. (Original) The method of Claim 1, wherein the superheated alloy includes at least one of the materials selected from the group consisting of aluminum, lead, tin, magnesium, manganese, strontium, titanium, silicon, iron, carbon, copper, gold, silver, and zinc.

5. (Original) The method of Claim 1, further includes the step of using the alloy substantially free of dendrites in at least one application selected from the group consisting of a thixocasting application and a rheocasting application.

6. (Original) The method of Claim 1, wherein the mixing of the nucleated alloy is accomplished by directing the nucleated alloy through a passive mixer.

7. (Original) The method of Claim 1, wherein the alloy substantially free of dendrites includes a primary particle size of about 100 microns or less.

8. (Original) The method of Claim 7, wherein the alloy substantially free of dendrites includes a primary particle size of about 70 microns or less.

9. (Original) The method of Claim 1, wherein the alloy substantially free of dendrites includes a shape factor value in the range of about 0.75 and about 0.95.

10. (Original) The method of Claim 1, further includes the step of quenching the nucleated alloy to form the alloy substantially free of dendrites.

11. (Original) The method of Claim 1, wherein the superheated alloy includes at least one grain-refining agent.

12. (Original) The method of Claim 11, wherein the grain-refining agent includes at least one of the materials selected from the group consisting of borides of titanium and borides of aluminum.

13. (Original) The method of Claim 11, wherein the grain-refining agent includes at least one of the materials selected from the group consisting of TiB_2, AlB_2, TiC, and Al_3Ti.

14. (Currently amended) The method of Claim 1, wherein the superheated alloy is ~~heated to~~ cooled from a temperature at least about 5°C above the liquidus temperature.

15. (Currently amended) The method of Claim 14, wherein the superheated alloy is ~~heated to~~ cooled from a temperature in the range of between about 10°C to about 15°C above the liquidus temperature.

16. (Original) The method of Claim 1, further includes the step of forming a billet from the alloy substantially free of dendrites.

17. (Original) The method of Claim 1, wherein at least a portion of the superheated alloy includes a metal recycled from a metal-forming process.

18. (Original) The method of Claim 1, further includes the step of directing the alloy substantially free of dendrites to a metal-forming process.

19. (Original) The method of Claim 18, wherein the alloy substantially free of dendrites directed to a metal-forming process includes a volume fraction of solids of at least about 30%.

20. (Original) The method of Claim 19, wherein the alloy substantially free of dendrites directed to a metal-forming process includes a volume fraction of solids in the range of from about 40% to about 60%.

21. (Currently amended) A continuous process for forming an alloy substantially free of dendrites, comprising the steps of:

a. directing a superheated alloy stream into a reactor, wherein the superheated alloy stream is continuously cooled and mixed at a temperature between a solidus temperature and a liquidus temperature of the alloy without raising the temperature of the alloy, thereby preventing melting of nuclei, for a period of time at least 10 minutes to form a nucleated alloy stream, wherein the nucleated alloy stream includes a plurality of nuclei distributed throughout, wherein essentially all of said nuclei are substantially free of entrapped liquid; and

b. ~~continuously controlling the temperature of the nucleated alloy stream to prevent the nuclei from melting and continuously mixing~~ cooling the nucleated alloy stream to below the solidus temperature at a rate of less than about 0.7° C per second when above the solidus temperature, to thereby form ~~to distribute the nuclei throughout, thereby continuously forming~~ an alloy having an average particle size of about 100μm or less and substantially free of dendrites.

22. (Cancelled)

23. (Currently amended) A method for forming an alloy substantially free of dendrites, comprising the steps of:

a. superheating a first metal;

b. superheating a second metal;

c. mixing the first and second metals to form a superheated alloy;

d. cooling the superheated alloy to a temperature between a solidus temperature and a liquidus temperature of the alloy to thereby form a plurality of nuclei~~, wherein essentially all of said nuclei are substantially free of entrapped liquid~~;

e. mixing the ~~superheated~~ nucleated alloy ~~to distribute the plurality of nuclei throughout the superheated alloy;~~ at the temperature between the solidus temperature and the liquidus temperature of the alloy, and without raising the temperature of the alloy to thereby prevent the nuclei from melting, for a period of time of at least 10 minutes;

~~f. controlling the temperature of the superheated alloy to prevent the nuclei from remelting; and~~

[[g.]] f. cooling the ~~superheated~~ nucleated alloy while the nuclei are distributed throughout to a temperature below the solidus temperature at a rate less than about 0.7° C per second. when above the solidus temperature, thereby forming an alloy substantially free of dendrites and an average particle size of less than about 100μm.

24. (Original) The method of Claim 23, wherein the fist metal comprises a dissimilar composition from the second metal.

25. (Original) The method of Claim 23, wherein each of the at least two metals are heated to nonequal temperatures.

26. (Currently amended) The method of Claim 23, wherein the first metal is superheated ~~heated~~ to a temperature in a range of between about 1°C and about 50°C above the liquidus temperature of the second metal.

27. (Currently amended) The method of Claim 23, wherein the second metal is superheated ~~heated~~ to a temperature in a range of between about 1°C and about 50°C above the liquidus temperature of the second metal.

28. (Currently amended) An alloy substantially free of dendrites formed by a method comprising the steps of:

a. cooling a superheated alloy to a temperature between a solidus temperature and a liquidus temperature of the alloy to thereby form a nucleated alloy, wherein the nucleated alloy includes a plurality of nuclei~~, wherein essentially all of said nuclei are substantially free of entrapped liquid~~;

b. ~~controlling~~ mixing the nucleated alloy at the temperature of the nucleated alloy between the solidus temperature and a liquidus temperature of the alloy, and

without raising the temperature of the alloy to thereby prevent the nuclei from melting, for a period of time of at least 10 minutes;

~~c. mixing the nucleated alloy to distribute the nuclei throughout;~~ and

[[d.]] c. cooling the nucleated alloy with nuclei distributed throughout to below the solidus temperature at a rate of less than about 0.7° C per second when above the solidus temperature, thereby forming an alloy substantially free of dendrites and an average particle size of about 100 μm or less.

29. (New) The method of Claim 1, wherein the nucleated alloy of step b. is formed by further including the steps of cooling the superheated alloy of step a. to a temperature below the solidus temperature and then raising the temperature of the alloy to the temperature of step b. between the solidus temperature and the liquidus temperature.

30. (New) The method of Claim 1 wherein the nucleated alloy of step b. is formed by cooling the superheated alloy of step a. directly from a temperature above the liquidus temperature to a temperature of step b. between the solidus temperature and the liquidus temperature.